

sanwa®

MG1000/MG500 INSULATION RESISTANCE TESTER INSTRUCTION MANUAL

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07-1409 2040 6012



[1] SAFETY PRECAUTIONS

Before use, read the following safety precautions.

Thank you for purchasing the Sanwa MG1000/MG500 digital insulation resistance tester. Before use, please read this manual thoroughly to ensure correct and safe use. Keep this Instruction Manual together with the product. Be sure to read the information under "▲WARNING" that is intended to prevent personal injury such as burn and electric shock and other serious accidents.

1-1 Explanation of Warning Symbols

The meaning of the symbols used in this manual and attached to the product is as follows:

▲: Very important instructions for safe use

- The warning messages are intended to prevent accidents to operating personnel such as burn and electric shock.

- The caution messages are intended to prevent incorrect handling and measurement which may damage the product.

▲: Dangerous voltages

⊥: Ground. ⎓: DC. ~: AC.

⊞: Fuse. □: Double or enhanced insulation.

1-2 Warning Messages for Safe Use

▲WARNING

The following instructions are intended to prevent personal injury such as burn and electric shock. Be sure to follow them when using the tester:

▲WARNING

- Never use the tester on a high-power or high-voltage line.
- Voltages above 70 VDC or 33 Vrms AC (46.7 V peak) are hazardous to human body. Never touch them.
- Disconnect circuit power before testing insulation resistance.
- Use caution with the high voltages output when performing insulation resistance measurement to avoid electric shock.
- To prevent electric shock, always discharge capacitive circuits after the insulation resistance measurement.
- Never input signals exceeding the maximum rated input value (see 1-3).
- Never use the tester for measuring voltages of lines connected to equipment (e.g. motors) that generates induced or surge voltage since it may exceed the maximum allowable overload input.
- Never use the tester if the tester or test leads are damaged or broken.
- Never use the tester with the rear-case or battery lid removed.
- When using the test leads, keep your fingers behind the finger guards.
- During measurement, do not change the function or range nor replace the plugs.
- Never use the tester when it is wet or with wet hands.
- Be sure to use the fuse of the specified rating and specification.
- When connecting the alligator clip, connect it to the grounding side of the object to be measured first. When disconnecting it, disconnect the test lead from the line first, and then disconnect the test lead from the grounding side of the measured object.
- Never attempt repair or modification, except for battery and fuse replacement.
- Inspect the tester at least once a year.
- This tester is for indoor use only.
- Never use the tester near equipment that generates strong electromagnetic waves or is charged.
- Do not use the instrument in a place where corrosive or explosive gas is produced.

▲CAUTION

- The measuring terminals output high voltages during insulation resistance measurement. To prevent damaging the tester and parts (including chips) with low or unknown withstanding voltages, connected to the measured electrical path (circuit), it is recommended to disconnect them from the electrical path before measurement. This care is specially important with computer equipment.
- The rated measuring voltage used in insulation resistance measurement should be as close as possible to the operating voltage of the circuitry to measure. For example, when measuring an electrical path of 200 V, it is recommended to use a tester with a rated measuring voltage of 250 V.
- While measuring insulation resistance, it will probable take time to get steady result value on display in case that there is electrostatic capacitance in the measured circuit.

1-3 Overload protection

The maximum rated input value and overload protection have been defined for the input terminals of each function as shown below.

Function	Max. Rated Input	Overload Protection
MΩ	-	MΩ range: Within 120 % of the rated measuring voltage.
V	600 Vrms	780 Vrms
4000 Ω	-	600 Vrms
40 Ω	-	Fuse, 0.5 A / 600 V

Measurement Category (Overvoltage Category)

Overvoltage measurement category II (CAT. II) :

Line on the primary side of equipment with power cord to be connected to the receptacle.

Overvoltage measurement category III (CAT. III) :

Line from the primary side or branch of equipment which directly takes in electricity from a distribution board to the receptacle.

Overvoltage measurement category IV (CAT. IV) :

Line from the service conductor to the distribution board.

[2] APPLICATIONS AND FEATURES

2-1 Applications

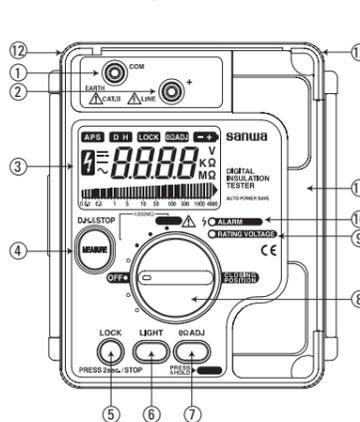
This instrument is a DC insulation resistance tester for use in measurement of insulation resistance of a power line and power equipment within the range of 600 V under CAT III.

2-2 Features

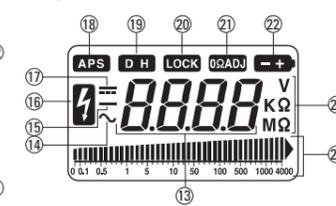
- Safety design in compliance with IEC61010-1
- MΩ function with automatic live circuit detection (>30 V AC/DC)
- Easy-to-read display showing large figures and log bar graph for reading in an analog feeling
- Automatic hold function to hold the last displayed value to look it safely after measurement
- LCD panel with backlight function
- Auto discharge function
- 40.00 Ω measurement function (≥200 mA short circuit current)

[3] NAMES AND FUNCTIONS OF COMPONENT UNITS

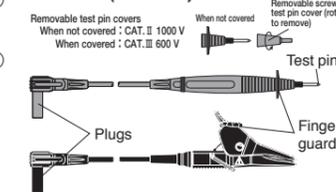
Instrument body



LCD panel



Test lead (TL-112a)



Strap (ST-50)



	Name	Description
①	EARTH/COM terminal	Grounding/COM terminal for connecting the black alligator clip.
②	LINE/+ terminal	Line/+ terminal for connecting the red test lead.
③	LCD panel	Displays the value, function name or voltage output status.
④	MEASURE button	MΩ measurement function: <ul style="list-style-type: none"> Press and hold the button to output the test voltage. When the button is released, the test voltage output is stopped, the circuit under test is discharged automatically, and the last displayed value appears on the display together with the D H indication. When the button is pressed during continuous test voltage generation using the LOCK button, the test voltage is stopped, the last displayed value is held, and the circuit under test is discharged automatically. 40 Ω measurement function: <ul style="list-style-type: none"> Press and hold the button to start measuring. When the button is released, the test voltage output is stopped and the last displayed value is held appears on the display together with the D H indication. When the button is pressed during continuous measurement using the LOCK button, the measurement is stopped and the last displayed value is held.

⑤	LOCK button	When pressed for more than 2 seconds, continuous test voltage is output and LOCK indication appears. To release the lock, press the LOCK or MEASURE button, the test voltage output is stopped, the circuit under test is discharged automatically, and the last displayed value appears on the display together with the D H indication. 40 Ω measurement function: When pressed for more than 2 seconds, LOCK indication appears and the tester continues measuring. To release the lock, press the LOCK or MEASURE button. The measurement is stopped and the last displayed value appears on the display together with the D H indication.
⑥	LIGHT button	Turns backlight on/off. The backlight goes off automatically after 10 seconds. <ul style="list-style-type: none"> When the LIGHT button is pressed during MΩ measurement which is performed by holding the MEASURE button, the generation of the measurement voltage is interrupted and the displayed value shows the D H indication.
⑦	0 Ω ADJ button	Zero Ohm adjustment for 40 Ω measurement function or when selecting the maximum MΩ measurement function.
⑧	Power/function switch	Turns the tester ON/OFF or to select a function. The body cover cannot be closed unless this switch is set to the OFF position.
⑨	RATING VOLTAGE indicator	Lights up in MΩ measurement function. It blinks when the test voltage drops below rated value.
⑩	ALARM indicator	Lights up when the input is about 30 V AC/DC or more. It can be used as the live circuit detection, etc.
⑪	Test lead storage space	Space to store the test leads and alligator clips.
⑫	Strap hook	To attach a strap.
⑬		Numeral and decimal point
⑭		AC voltage operation indicator
⑮		Negative value indicator
⑯		MΩ measurement function: Lights up when the tester outputs test voltage. Lights up when the object to be measured is charged about 30 V or more. V measurement function: Lights up when the input is 600 Vrms or more.
⑰		DC voltage operation indicator.
⑱		Auto Power Save mode indicator The tester enters "power save mode" automatically if it has not been operated for about 30 minutes. The tester come out of "power save mode" when power/function switch is turned to OFF once and set to the required function again. To cancel Auto Power Save function, turn the power/function switch from OFF position to any desired function while holding the LIGHT button pressed. *A small electric current from power supply is present in Auto Power Save mode. Be sure to set the power/function switch to "OFF" after measurement.
⑲		Data Hold indicator
⑳		Test lock (continuous test voltage output) indicator
㉑		0 Ω adjustment indicator
㉒		Low battery warning indicator: Appears when the batteries are exhausted (to about 7.2 V or less). When the indicator appears or blinks, replace the batteries with new ones.
㉓		Unit indicators.
㉔		Logarithmic bargraph Disabled in the 40 Ω measurement function

[4] SPECIFICATIONS

4-1 General Specifications

AC Sensing	Average value
LCD	4200 count with log bar graph
Sampling rate	Approx. 2 times / sec.
Range selection	Auto only Range up: approx. 4200 count or over, Range down: approx. 380 count or below
Over-range indication	"OL" indication on LCD V function: 780 V or over MΩ, 4000 Ω, 40 Ω function: Approx. 4200 count or over
Polarity indication	"—" indication only when negative input
Low battery indication	"+" lights or flickers at about 7.7 V-7.2 V or below
Environmental condition	Altitude 2000 m or below, pollution degree 2
Operating temperature / humidity	0 °C to 40 °C and maximum relative humidity 90 % (No condensation)
Storage temperature / humidity	-10 °C ~ 50 °C, 70 %RH or below (with battery removed).
Power supply	R6P 1.5 V x 6 pcs (MG500) ; LR6 1.5 V x 6 pcs (MG1000)

Time of measurement*	MG500 : Approx. 500 times (with manganese battery) MG1000 : Approx. 300 times (with alkaline battery)
Safety	IEC61010-1, IEC61010-2-030, IEC61010-2-033 CAT.III 600 V IEC61557-1/2/4, IEC60529-IP54, IEC61010-031
EMC	IEC61326
Dimensions	170 (L) X 142 (W) X 57 (H)
Mass	Approx. 600 g (battery included)
Power consumption	Approxox. 7 mA at V function
Accessories	test leads (TL-112a), Strap (ST-50), instruction manual

*At 5-sec. ON / 25-sec. OFF

4-2 Measurement Range and Accuracy

Temperature 23 ± 5°C, humidity 45 % to 75 % RH.

rdg: Reading. dgt: Digits

4-2-1 Insulation resistance measurement functions (kΩ, MΩ)

Model:MG1000

Nominal test voltage & Measurement Range	Center scale	Measurement Range	Accuracy
250 V 4.000 MΩ/40.00 MΩ 400.0 MΩ/4000 MΩ	10 MΩ	1st effective measurement range 0.500~20.00 MΩ 2nd effective measurement range 0~0.499 MΩ 20.01~4000 MΩ	±(3 %rdg+4 dgt) ±(5 %rdg+5 dgt)
500 V 4.000 MΩ/40.00 MΩ 400.0 MΩ/4000 MΩ	100 MΩ	1st effective measurement range 1.000~500 MΩ 2nd effective measurement range 0~0.999 MΩ 501~4000 MΩ	±(3 %rdg+4 dgt) ±(5 %rdg+5 dgt)
1000 V 4.000 MΩ/40.00 MΩ 400.0 MΩ/4000 MΩ	100 MΩ	1st effective measurement range 2.000~1000 MΩ 2nd effective measurement range 0~1.999 MΩ 1001~4000 MΩ	±(3 %rdg+4 dgt) ±(5 %rdg+5 dgt)
Open circuit voltage	1 to 1.25 times of nominal test voltage		
Rated current	1.0-1.2 mA (250 V @0.25 MΩ, 500 V @0.5 MΩ, 1000 V @1 MΩ)		
Short-circuit current	2 mA or less		
Live circuit detection	At ≥30 V AC/DC or more, inhibits test, buzzer sounds and ALARM indicator lights up.		

Model:MG500

Nominal test voltage & Measurement Range	Center scale	Measurement Range	Accuracy
125 V 400.0 kΩ 4.000 MΩ/40.00 MΩ 400.0 MΩ/4000 MΩ	1 MΩ	1st effective measurement range 20.0 kΩ~10.00 MΩ 2nd effective measurement range 0~19.9 kΩ 10.01~4000 MΩ	±(3 %rdg+4 dgt) ±(5 %rdg+5 dgt)
250 V 400.0 kΩ 4.000 MΩ/40.00 MΩ 400.0 MΩ/4000 MΩ	10 MΩ	1st effective measurement range 50.0 kΩ~20.00 MΩ 2nd effective measurement range 0~49.9 kΩ 20.01~4000 MΩ	±(3 %rdg+4 dgt) ±(5 %rdg+5 dgt)
500 V 400.0 kΩ 4.000 MΩ/40.00 MΩ 400.0 MΩ/4000 MΩ	100 MΩ	1st effective measurement range 100.0 kΩ~500 MΩ 2nd effective measurement range 0~99.9 kΩ 501~4000 MΩ	±(3 %rdg+4 dgt) ±(5 %rdg+5 dgt)
Open circuit voltage	1 to 1.3 times of nominal test voltage		
Rated current	1.0-1.2 mA (125 V @0.125 MΩ, 250 V @0.25 MΩ, 500 V @0.5 MΩ)		
Short-circuit current	2 mA or less		
Live circuit detection	At ≥30 V AC/DC or more, inhibits test, buzzer sounds and ALARM indicator lights up.		

Note

When the displayed value is 2000 MΩ or more, the lowermost digit is fixed at 0.

* Insulation resistance measurement principle:

Detecting a current flowing through the circuit to be measured being applied a DC voltage, the insulation resistance is calculated from "the voltage / the current".

Operating instrumental uncertainty:±30 % variation due to changing "E1: Position, E2: Supply voltage, E3: Temperature" (This specification describes maximum values accepted by the standard.)

4-2-2 Voltage measurement function (AC/DCV)

Range	Resolution	Accuracy	Input Resistance	Max. Overload Protection
AC/DC 600 V	1 V	±(3 %rdg+2 dgt)	9 MΩ	780 Vrms

Note

ACV and DCV are automatically detected.
Sensitivity: 2 V or higher.
AC frequency bandwidth: 45-400 Hz
The ALAMP indicator lights up when the input is ≥ 30 V AC/DC.
“**F**” appears and buzzer sounds if the input is ≥ 600 Vrms.
Maximum display value: 780 V.

4-2-3 4000 Ω measurement function / Continuity buzzer (Ω)

Range	Resolution	Accuracy	Input Resistance	Max. Overload Protection
4000 Ω	1 Ω	±(3 %rdg+3 dgt)	≥ 3 V	600 Vrms

Note

A buzzer sounds below about 40 Ω.
A buzzer sounds and the ALARM indicator lights up when the input is ≥ 30 V AC/DC.

4-2-4 40 Ω measurement function (Ω)

Display Range	40.00 Ω
Measurement range	0.01 Ω to 40.00 Ω
Accuracy	±(3 %+ 10 dgt) (after 0 Ω ADJ)
Resolution	0.01 Ω
Open Circuit voltage	6 V (typical value)
Short-circuit current	200 mA minimum (≤ 2.0 Ω)
Protection	Fuse (0.5 A/600 V)

Note

The bargraph display is disabled.

[5] MEASURING PROCEDURE

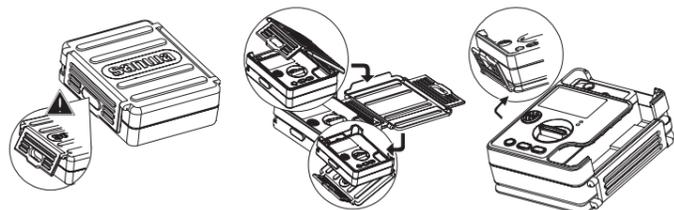
WARNING

- Be sure to conduct the start-up inspection described in section 5-2 below.
- Before measurement, disconnect power supply from the object (circuit) to be measured.
- After measurement, be sure to discharge the high voltage charged in the measured object.
- During measurement, keep your fingers behind the finger guards of the test leads and do not touch the metallic part of the alligator clips.
- After measurement, be sure to turn the power/function switch to “OFF” position to prevent electric shock and battery exhaustion.

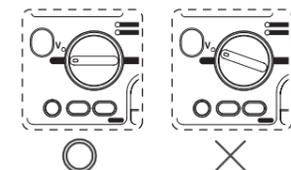
CAUTION

- When selecting the maximum test voltage (insulation resistance measurement), hold the 0 Ω ADJ button pressed while turning the power/function switch. Otherwise, the display shows “Err0” and the test voltage will not be output even if the MEASURE or LOCK button is pressed.
- When the object to be measured is grounded, usually the alligator clip is connected to the ground (EARTH) and the test lead to the measured circuit (LINE). (This connection method usually results in a lower measurement value than the opposite connection method.)
- To prevent measurement errors, prevent the test lead connected to the LINE terminal from touching the object to be measured or ground whenever possible.
- The insulation resistance varied greatly depending on the temperature and humidity as well as on the output voltage (test voltage). In general, higher temperature, humidity and/or output voltage mean lower insulation resistance.
- Measurement is inhibited if voltage (≥ 30 V AC/DC) is present in the circuit.
- Keep in mind that the time of auto discharge will be delayed if fuse has broken.

5-1 Opening/closing the body cover



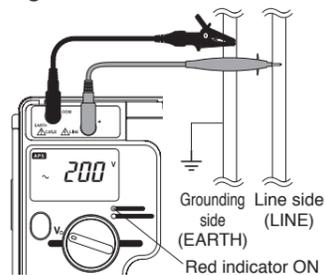
The body cover cannot be closed unless the function switch is OFF.



5-2 Start-up inspection

Inspection/ Check	Method
Appearance	Check if the instrument body appears damaged.
Batteries	Check if + appears on the top right of the LCD. If -+ appears or blinking, replace all batteries with new ones (see section 6-4-1).
Test leads	Select the 4000 Ω measurement function, short the test lead and alligator clip, and ensure the displayed value is no more than 1 Ω. If “OL” is displayed, replace the test leads as they may be damaged.
Fuse	Select the 40 Ω measurement function, short the test lead and alligator clip, and ensure the displayed value is no more than 0.05 Ω. If “OL” is displayed, replace the fuse as it may be damaged (see section 6-4-2).

5-3 Voltage measurement method



Note
ACV and DCV are automatically detected.

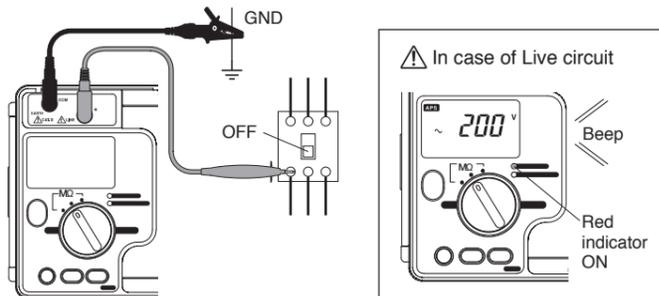
5-4 Insulation resistance measurement method

5-4-1 Buttons used in the measurement

Measurement: **MEASURE** button, **0 Ω ADJ** button (to set the max test voltage function)
Continuous measurement: **LOCK** and **MEASURE** buttons.

5-4-2 Measurement method

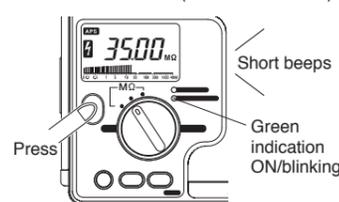
- Connect the test leads to the object (circuit) to be measured.



If the object to be measured is a live circuit (≥ 30 V AC/DC), the voltage is displayed, buzzer sounds, and the ALARM indicator lights up. In this case, the test voltage cannot be output by pressing the MEASURE or LOCK button. Disconnect the power supply from the object to be measured and try again.

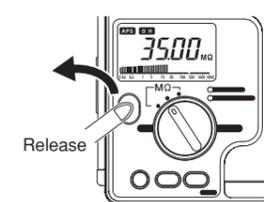
- Output the test voltage.

Start measurement (**MEASURE** button)



The test voltage is output when the **MEASURE** button is held pressed. **F** appears and short buzzer sounds during this operation.

- End the measurement.

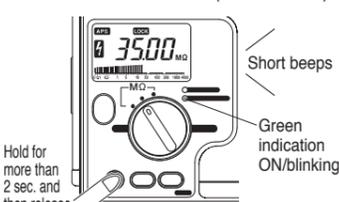


Release the **MEASURE** button to stop outputting the test voltage.

At the moment the test voltage output is stopped, the last displayed value is held automatically (**DH** indication) and the measured object (circuit) is discharged automatically.

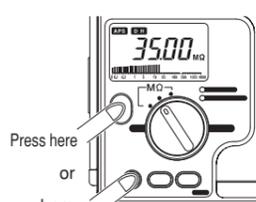
When the measured object (circuit) is discharged below 30 V, the **F** indicator goes off.

Continuous measurement (**LOCK** button)



Press and hold the **LOCK** button for more than 2 seconds to output the test voltage continuously. **F** and **LOCK** appears and short buzzer sounds during this operation.

- End of continuous measurement



Press the **MEASURE** or **LOCK** button to stop outputting the test voltage.

Note

- An oscillation tone may be heard during measurement, but this is not malfunction.
- The automatically held value is retained until the start of the next measurement or the tester enters APS mode. The held value is released and the new measurement value is displayed when the next measurement is started.
- If a measuring point of certain equipment for insulation resistance measurement is unknown, contact the manufacturer of that equipment to ensure correct measurement.

5-5 4000 Ω Resistance measurement / Continuity check method

5-5-1 Buttons used in measurement

No button is used.

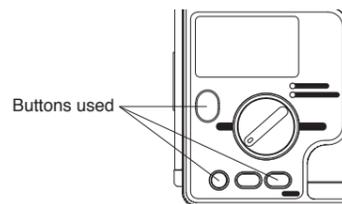
5-5-2 Measurement method

- Set the power/function switch to “4000 Ω.”
- Connect the test lead to the object to be measured.
- Read the displayed value.

5-6 40 Ω measurement method

5-6-1 Buttons used in measurement

Measurement: **MEASURE** button and **0 Ω ADJ** button.
Continuous measurement: **LOCK** button, **0 Ω ADJ** and **MEASURE** button.



5-6-2 Measurement methods

Method using the **MEASURE** button:

- Set the function switch to “40.00 Ω.”
- Short-circuit the test leads, press the MEASURE button, and release the MEASURE button when the tester detects a stable reading. The displayed value will be held.
- Press the 0 Ω ADJ button to reset the displayed value to “0.00 Ω.” [0 Ω ADJ] should light up at this time.
- Connect the test leads to the object to be measured, and press the MEASURE button.
- To end measurement, release the MEASURE button. The last displayed value will be held automatically.

Method using the **LOCK** button:

- Set the function switch to “40.00 Ω.”
- Short-circuit the test leads and press the LOCK button.
- When the tester detects a stable reading, press the 0 Ω ADJ button to reset the displayed value to “0.00 Ω.” [0 Ω ADJ] should light up at this time.
- Connect the test leads to the object to be measured and read the displayed value.
- To end measurement, press the MEASURE or LOCK button. The last displayed value will be held automatically.

Caution: The measurement consumes a large amount of current. Use caution with the battery exhaustion. The displayed value may not become “0.00” depending on the contact condition while shorting the test leads.

[6] MAINTENANCE

WARNING

- The following instructions are very important for safety. Read this manual thoroughly to ensure correct maintenance.
- Calibrate and inspect the meter at least once a year to ensure safety and maintain its accuracy.

6-1 Maintenance inspection

- Appearance: Is the meter not damaged due to falling or other cause?
 - Test leads: Are the test leads not damaged, or is the core wire not exposed from any part or broken?
- If any of the above problems exists, stop using the meter and request for repair.

6-2 Calibration / Inspection

For more information, please contact your dealer or Sanwa agent.

6-3 Storage

CAUTION

- The panel and case are not resistant to volatile solvent and must not be cleaned with thinner or alcohol.
- The panel and case are not resistant to heat. Do not place the tester near heat-generating devices.
- Do not store the tester in a place where it may be subjected to vibration or from where it may fall.
- Do not store the tester in places under direct sunlight, or hot, cold or humid places or places where condensation is anticipated.
- If the tester will not be used for a long time, remove the battery.

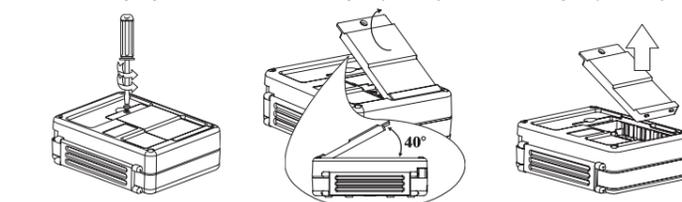
6-4 Battery / Fuse replacement

Battery when the meter is shipped:
A battery for monitoring has been installed prior to shipment from the factory. It may be discharged before the expiration of the described battery life.
*The battery for monitoring is a battery used to check the functions and performance of the product.

WARNING

- If the rear case is removed with an input being applied to the measuring terminals, you may suffer electric shock. Before starting replacement, always make sure no input is being applied and the function switch is OFF.
- Be sure to use the fuse of the specified rating and specification. Never use a substitute nor short the fuse terminals.

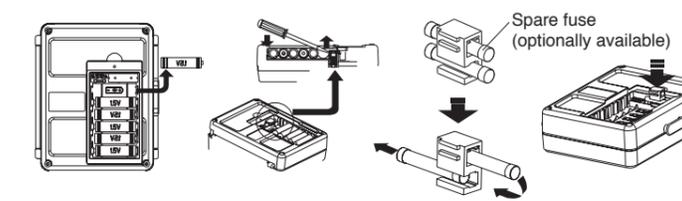
6-4-1 Battery replacement: R6P 1.5 V x 6 pcs (MG500) ; LR6 1.5 V x 6 pcs (MG1000)



Note: Use caution with battery polarity when replacing batteries.

6-4-2 Fuse replacement

Fuse: Part No. F1202, Ø6.3 X 32 mm, 0.5 A/600 V, breaking capacity 20 kA.



[7] AFTER-SALE SERVICE

7-1 Warranty and Provision

Sanwa offers comprehensive warranty services to its end-users and to its product resellers. Under Sanwa's general warranty policy, each instrument is warranted to be free from defects in workmanship or material under normal use for the period of one (1) year from the date of purchase.
This warranty policy is valid within the country of purchase only, and applied only to the product purchased from Sanwa authorized agent or distributor.
Sanwa reserves the right to inspect all warranty claims to determine the extent to which the warranty policy shall apply. This warranty shall not apply to disposables batteries, or any product or parts, which have been subject to one of the following causes:

- A failure due to improper handling or use that deviates from the instruction manual.
- A failure due to inadequate repair or modification by people other than Sanwa service personnel.
- A failure due to causes not attributable to this product such as fire, flood and other natural disaster.
- Non-operation due to a discharged battery.
- A failure or damage due to transportation, relocation or dropping after the purchase.

7-2 Repair

Customers are asked to provide the following information when requesting services:

- Customer name, address, and contact information
- Description of problem
- Description of product configuration
- Model Number
- Product Serial Number
- Proof of Date-of-Purchase
- Where you purchased the product

Please contact Sanwa authorized agent / distributor / service provider, listed in our website, in your country with above information. An instrument sent to Sanwa / agent / distributor without above information will be returned to the customer.

Note:

- Prior to requesting repair, please check the following:
Capacity of the battery, polarity of installation and discontinuity of the test leads.
- Repair during the warranty period:
The failed meter will be repaired in accordance with the conditions stipulated in 7-1 Warranty and Provision.
- Repair after the warranty period has expired:
In some cases, repair and transportation cost may become higher than the price of the product. Please contact Sanwa authorized agent / service provider in advance.
The minimum retention period of service functional parts is 6 years after the discontinuation of manufacture. This retention period is the repair warranty period. Please note, however, if such functional parts become unavailable for reasons of discontinuation of manufacture, etc., the retention period may become shorter accordingly.
- Precautions when sending the product to be repaired To ensure the safety of the product during transportation, place the product in a box that is larger than the product 5 times or more in volume and fill cushion materials fully and then clearly mark “Repair Product Enclosed” on the box surface. The cost of sending and returning the product shall be borne by the customer.

7-3 SANWA web site

http://www.sanwa-meter.co.jp/
E-mail: exp_sales@sanwa-meter.co.jp